Mass Spectral Analysis in the Characterisation of Fungi Using MALDI-TOF Mass Spectrometry

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Fungi, include the filamentous fungi and the unicellular yeasts, are very important organisms and they constitute the 5^{th} kingdom. They are estimated to be 1.5 x 10^6 species of fungi of which only 5% have been identified formally. The around 800-1000 new species described every year is a poor contribution to fill the gap in our mycological knowledge. The standard method for identifying and classifying filamentous fungi remains morphology (e.g. colour, shape, size and ornamentation of conidia and the length of the conidiophores) due in general filamentous fungi have more distinctive morphologies than, for example, single celled bacteria and yeasts. However, the literature provides extensive examples of problems. Unreliable morphological minutia to describe new species and variability within the morphological characters of accepted species are constant issues. The use of physiological and biochemical characters have also been attempted (e.g. colony colour, growth rates, secondary metabolites production) although these also are variable in many cases. To confuse more the situation, to coin a fungus with a name the International Code of Botanical Nomenclature is used which in many cases does not fit properly the mycological reality. Additionally, different names are given according the sexual stage of the fungus (anomorphic/assexual or teleomorphic/sexual stage). The discovery published last January in Nature by C. M. O'Gorman and colleagues of a sexual stage of the pathogen fungus *Aspergillus fumigatus* introduce a new scientific name with priority for it, *Neosartorya fumigata*. In this case, *Aspergillus fumigatus* must remain from pragmatic and clinical point of view. With the molecular biology methods the mycology has experience a great renaissance reaching nowadays about 40 fungal whole gemones sequenced. The comparative fungal genomics is now a possibility to be explored. However, the ITS rDNA sequences in some groups have not power enough to be discriminative. Some of the above constraints have led to increasing interest in Matrix Assisted Laser Desorption/Ionisation - Time Of Flight Intact Cell Mass Spectrometry (MALDI-TOF ICMS) for rapid and reliable fungal identifications. Results obtained with MALDI-TOF ICMS give great insights in fungal identification and the technique is (a) rapid, (b) inexpensive in terms of labour and consumables, and (c) reliable when compared with other biological techniques. Using MALDI-TOF ICMS the results showed a great potential to the fungal identification and characterization and it is another additional step for our polyphasic fungal identification approach. However, even with the polyphasic approach fungal identifications remain in some situations time-consuming and decisions regarding what represents a species tend to be subjective.